Louisiana was used. The authors did not follow the recommended HSM procedure for calibrating the predictive model due to the unavailability of data. However, the research team was able to create a database with the most important highway variables of ADT, segment length, lane width, shoulder width and type, horizontal curve, and driveway density. Since the average prediction model values were smaller than the observed values, a calibration parameter was computed as a function of ADT. The results of their analysis are presented in two groups; the first group consisted of 26 randomly selected control sections and the second group consisted of 16 control sections in the top 30 for crash frequencies for three years. The analysis indicates that the HSM model successfully predict crash frequencies, the level of effort required to obtain the data necessary to calibrate the model was a challenge.

The second study (Martinelli 2009), calibrates the HSM crash prediction model for the Italian Provence of Arezzo on 1,300 kilometers of rural, 2-lane highways. The authors evaluate the results of the HSM prediction model in a different country with differences in environment, road characteristics, driver behavior, and crash reporting than where the model was developed. The comparison between the observed crashes and four models with different calibration procedures are presented and each of the models strongly overestimates crashes. Additionally, it was found that the models overestimated crashes at low crash locations and an underestimation at the high crash locations. However, the authors conclude that calibration of the model is absolutely necessary to avoid the over prediction found in the base model.

6.3 Methodology

6.3.1 <u>HSM predictive method calibration</u>

The HSM predictive methods were developed such that they can be calibrated and adjusted based on local conditions. Examples of local conditions that may differ from the set predictive model include climate, driver population, and crash reporting thresholds. Calibration of these predictive models can be done to adjust for these local conditions.

The HSM predictive method for rural 2-lane, 2-way highways was applied in this evaluation to North Carolina highways. This application was applied following the steps provided in the HSM to estimate the expected average crash frequency of curve segments. The HSM predictive model contains 18 steps, with the focus of the paper on steps 9, 10, and 11, which are applied after segments have been identified and data collection including crash history and geometric conditions have been captured. These steps are repeated for each segment and are used to identify a safety performance function (SPF), crash modification factor, and calibration factor, that are used in the predictive model to calculate predicted crashes for each segment.

6.3.2 <u>Step 9: Select and apply SPF</u>

Once the crash history and geometric design features have been imputed for the selected segments (curves, for this analysis) the next step is to determine the appropriate SPFs for each site. The SPF determines the predicted crash frequency with base conditions and is later adjusted to local conditions using the calibration factor. Using the base conditions in the HSM, the SPF for each segment was found using the following equation: